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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/879,335	06/11/2001	Vishnu K. Agarwal	MI22-1568	4063
21567	7590	12/16/2003	EXAMINER	
WELLS ST. JOHN P.S. 601 W. FIRST AVENUE, SUITE 1300 SPOKANE, WA 99201			HUYNH, YENNHU B	
			ART UNIT	PAPER NUMBER
			2813	

DATE MAILED: 12/16/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/879,335

Applicant(s)

AGARWAL ET AL.

Examiner

Yennhu B Huynh

Art Unit

2813

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 September 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☐ Claim(s) 1-50 and 58-71 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-50 and 58-71 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 15.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

This Office Action is in response to the Amendment E filed on 9/22/03.

New added claims 66-71.

Information Disclosure Statement

The information disclosure statement filed on 9/22/03 is being considered by the examiner.

Oath/Declaration

Oath/Declaration filed on 6/11/01 is accepted.

Specification

The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-8, 13-19, 21, 58 & 60-71 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gonzalez (U.S. 5,608,249) in view of Graettinger et al. (U.S. 5,843,830).

Claims are rejected under 35 U.S.C. 103(a) as being anticipated by Gonzales at figs. 1-8 in col. 1-10 disclose reduced area storage node junction, which include:

-Re. claims 1,2,16, 58 & 60-71: forming an insulation layer 30 over substrate 12, the substrate include an electronic device transistor 18 (fig.1); forming a barrier layer 41 formed on the insulation layer 30 and on the substrate 12, to shift inducing material over the substrate (figs. 4 & 5, col.6, line 24); a second insulation layer 52 over the barrier layer (fig.8); forming an opening at least into the insulation layer (figs.1 & 2); forming a high K capacitor dielectric layer 46 at least within the opening (figs. 7 & 8, col.6, lines 60-63); and providing a threshold voltage shift inducing material over the barrier layer, the barrier layer retarding movement of the threshold voltage shift inducing material into the electronic device (col. 6, lines 24-30).

However, Gonzales et al. do not disclose forming an insulative barrier layer type, and being above the elevational height of the electronic device.

Graettinger et al. at figs.1-10 in related text col. 1-8 disclose a method for forming a capacitor, which include diffusion barrier layer 70 is silicon nitride material and being above the elevational height of the electronic device (figs. 5-7, col. 4, lines 52-60).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine Gonzalez invention by incorporation the insulation silicon nitride diffusion barrier to obtain a thermal stable due to its impermeable barrier

characteristic or the anti- diffusion properties; and wherein the diffusion barrier layer being above the elevational height of the electronic device to prevent the intermixing of the contact filling materials to the underlying silicon.

Gonzalez also does not disclose wherein the barrier layer consists essentially of a globally planar barrier layer (cls. 4,18,24,31,40 & 48).

-Re: claims 4,18: Graettinger et al. also disclose wherein the barrier layer 70 consists essentially of a globally planar barrier layer in relative to layer 80 (cols. 4 & 5 lines 66-8).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine Gonzalez invention by incorporation globally planar diffusion barrier to obtain a planar surface area for expected result in forming subsequent layers.

Gonzalez also disclose:

-Re. claims 3 & 17: wherein the barrier comprises of nitride (col.6, lines 9-14).

-Re. claim 5: wherein the forming an opening further comprises forming a congruent opening through the barrier layer (figs. 1-6).

-Re. claim 6: wherein the opening is formed completely through the insulation layer (figs. 2-8).

-Re. claims 7 & 19: wherein the dielectric layer comprises material with high dielectric constant, and Ta₂O₅ is a type of high dielectric constant (col.6, lines 60-63).

-Re. claims 8 & 59: wherein the threshold voltage shift material comprises providing at least one impurity comprising layer over the barrier layer an insulation layer (col.6, lines 24-29).

-Re. claim 13: wherein the electronic device comprises a transistor 18 (figs. 1-8).

-Re. claim 14: wherein the substrate comprises a bulk semiconductor wafer (col.1, lines 18-21).

-Re. claim 15: forming a capacitor electrode 44 at least within the opening before forming the dielectric layer 46 (figs. 6-8, col.6, lines 33-35 and 60-63).

-Re. claim 21: forming a capacitor electrode 44 within the opening before forming the dielectric layer (fig. 7).

Claims 22-35 & 61-64 are rejected under 35 U.S.C. 102(e) as being anticipated by Parekh et al. (U.S. 6,165,833).

Parekh et al. at figs. 1-7 in col. 1-6 disclose method of forming capacitor, which include:

-Re. claims 22 & 29: forming a barrier layer 25 to Vt inducing material over a substrate 12 include an electronic device 14 (col.4, lines 12-15); forming an insulation layer 32 over the barrier layer 25; forming an opening 34 into at least the insulation layer 32; forming a high K capacitor dielectric layer 42 at least within the opening 34; and

providing Vt shift inducing material over the barrier layer and insulation, the barrier layer retarding movement of the Vt shift inducing material into the electronic device 14 (figs. 3-7, col. 3, lines 2-5 & 9-13 and col. 4 & 5, lines 12-3).

-Re. claims 23,24,30,31 & 61-64: wherein the barrier layer 25 is a silicon nitride, a planarized barrier layer, and formed on the substrate and insulation layer (figs. 3-6, col.4, lines 12-33).

-Re. claims 26 & 33: wherein the dielectric layer 42 comprises material with high dielectric constant Ta₂O₅ (col. 5, lines 4-6).

- Re. claims 27 & 34: wherein the providing Vt shifts inducing material comprising oxide annealing the dielectric layer and nitride (col.4 & 5, lines 53-3 and col. 6, lines 25-33 & 40-46)

-Re. claims 28 & 35: forming a capacitor electrode 36 at least within the opening 34 before forming the dielectric layer 42 (col.4, lines 43-53).

-Re. claims 25 & 32: wherein the opening 34/56 is formed completely through the second insulation layer 32, barrier layer 25 and into the first insulation layer 26 by plug 28/30 (fig.7, col.5, lines 17-29).

Claims 36 -50 & 65 are rejected under 35 U.S.C. 102(e) as being anticipated by Thakur et al (U.S. 6,251,720B1).

Thakur et al. at figs.1-5 in col. 1-18 disclose a HDC capacitive dielectric film in capacitor, which include:

-Re. claims 36-38,43,45 & 46: forming an insulation layer 116 over substrate 101 including an electronic device 110; an opening into the insulation layer and having a sidewall (fig. 1A); a capacitor electrode 104 at least within the opening and over the sidewall; after forming the capacitor electrode, forming a barrier layer 122 by CVD (col.8) to Vt shift inducing material at least over the insulation layer, wherein the barrier layer has a thickness of sidewall 102 is about between 100-4000 angstroms (col.10, lines 8-11), then forming a high K capacitor dielectric layer 102 at least over the insulation layer and capacitor electrode (col.8); providing Vt shift inducing material over the barrier layer to the electronic device (col. 8 & 9, lines 58-24).

-Re. claims 39, 47 & 65: wherein the barrier layer 122 comprises Si_3N_4 and formed on the insulation layer (col.5, lines 36-50).

-Re. claims 40 & 48: wherein the barrier layer is planarized in the structure (col. 10, lines 12-14)

-Re. claims 41 & 44: wherein the dielectric layer 102 comprises Ta_2O_5 (col.10, lines 1 & 8-11).

-Re. claims 42 & 49: wherein annealing the dielectric with oxide and N_2O (col. 10, lines 23-53)

-Re. claim 50: wherein annealing the dielectric and forming the barrier layer before the annealing structure (col. 10, lines 54-58).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 9-12 & 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gonzalez (U.S. 5,608,249) in view of Tsunemine (U.S. 5,699,291).

Gonzalez disclose substantially all of claimed invention, except annealing the dielectric layer (cl.9); annealing with oxide and N₂O (cls. 10 & 12); the heating treatment at least about 600 C degrees with nitrogen containing oxide and a partial pressure of about 200 mmTorr (cl.11). Tsunemine at figs. 1-19 in col.1-4 disclose a method of manufacturing semiconductor memory device, which include:

-Re. claims 9-12 & 20: wherein the providing V_t shift inducing material comprising oxide, N₂O annealing the dielectric layer 102, at least about 200-950 C degrees the heating at least about 600 C degrees with nitrogen containing oxide and a partial pressure of about 1-25 atmospheres (col.10, lines 23-46).

It would have been obvious to one having skill in the art at the time the invention was made to modify the invention of Gonzalez by incorporating the dielectric annealing at a high temperature to densify the layer and prevent leakage current problem.

Response to Arguments

Applicant's arguments with respect to claims 1-50 and 58-71 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Yennhu B Huynh whose telephone number is 703-308-6110 (and the new telephone number will be effected from 2/5/04). The examiner can normally be reached on 8.30AM-7.00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr., can be reached on 703-308-4940. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-7724.

Yennhu Huynh
Examiner
12/8/03

